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Parietex™ Composite mesh versus DynaMesh®-IPOM for laparoscopic incisional and ventral hernia repair: a retrospective cohort study

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ABSTRACT

INTRODUCTION Laparoscopic incisional and ventral hernia repair (LIVHR) is widely accepted and safe but the type of mesh used is still debated. We retrospectively compared postoperative outcomes with two different meshes commonly used in LIVHR.

METHODS This is a retrospective study of patients who underwent incisional hernia repair between January 2008 and December 2010. Two meshes were used: Parietex™ Composite (Covidien, New Haven, CT, USA) and the DynaMesh®-IPOM (FEG Textiltechnik mbH, Aachen, Germany). The two groups were compared with respect to recurrence rates, incidence of seroma and intestinal obstruction.

RESULTS Among the 88 patients who underwent LIVHR, 75 patients (85.2%) presented with primary incisional hernia, 10 (11.4%) presented with a first recurrence and 3 (3.4%) presented with a second recurrence. Median follow-up was 53.6 months (range 40–61 months). 12.9% of patients had recurrence in the Parietex™ Composite mesh group (n=62) in comparison to 3.8% in the DynaMesh®-IPOM mesh group (n=26; P=0.20). DynaMesh®-IPOM was associated with a significantly higher incidence of intestinal obstruction secondary to adhesions (11.5% *vs.* 0%, P=0.006) and lower incidence of seroma and haematoma formation compared to Parietex™ composite mesh group (0% *vs.* 6.4% of patients; P=0.185).

CONCLUSIONS LIVHR is a safe and feasible technique. Dynamesh®-IPOM is associated with a significantly higher incidence of adhesion related bowel obstruction, albeit with a lower incidence of recurrence, seroma and haematoma formation compared with Parietex™ Composite mesh. However, there is a need for further well-designed, multicentre randomised controlled studies to investigate the use of these meshes.

KEYWORDS
Incisional hernia – Laparoscopic mesh repair

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Introduction

An incisional hernia is any abdominal wall gap with or without a bulge in the area of a postoperative scar, perceptible or palpable by clinical examination or imaging.[1] Incisional hernias have been traditionally managed with open mesh repair with various techniques for mesh placement used, such as onlay, inlay and sublay (retrorectus) techniques.[2] In the last 20 years, techniques for laparoscopic incisional hernia repair have evolved immensely. Laparoscopic incisional and ventral hernia repair (LIVHR) is now widely accepted for the repair of small- to medium-sized ventral hernia defects. While it is sometimes possible to repair large defects using this technique, these defects often require component separation and abdominal wall reconstruction.[3] Laparoscopic repair has the advantages of a shorter hospital stay, less incidence of wound infection, less pain and adhesion formation.[4] Common complications following laparoscopic mesh repair of incisional hernia are seroma formation, ileus, pain and wound infection.[5] Intraperitoneal onlay placement of mesh is associated with poorer short- (ileus) and long-term outcomes (recurrence) and the risk of serious complications, such as bowel injury, are higher with the laparoscopic technique.[4,6] The recurrence rate after laparoscopic incisional hernia repair has been reported to be between 0 to 9%.[5]

With advances in technology, various types of mesh and mesh fixation devices have become available. The choice of mesh in LIVHR is still open to debate, and the search for the 'ideal mesh' is still on.[7] We performed a retrospective study at our centre, comparing two types of mesh commonly used, with a view to informing future surgical practice.

Materials and Methods

A prospectively maintained database of all patients undergoing LIVHR at a district general hospital was reviewed for a 3-year period between January 2008 and December 2010. The study has been reported in the line with the STROBE Statement (Strengthening the reporting of observational studies in epidemiology). Data on baseline demographics, patient characteristics, intraoperative factors, and short- and long-term outcomes were collected.

Preoperative assessment

Patients were assessed with clinical examination regarding their functional status, weight, American Association of Anesthesiologists (ASA) grade, type and size of hernia defect. Those with clinically large hernias (defect size more than 10cm), multiple defects and/or a complex surgical history were scanned using computed tomography (CT) to assess the size of defect prior to surgery and to define anatomy.

Operative approach

Access to the abdominal cavity was achieved either by open insertion (Hasson's technique) or under direct vision using a 12 mm Endopath® XCEL® (Ethicon Endo-Surgery Europe GmbH, Norderstedt, Germany) port. The abdominal wall defect was defined with blunt and/or sharp dissection and adhesiolysis. The hernia sac was not excised. An intraperitoneal onlay mesh with a minimum circumferential overlap of 5cm around the defect, was placed and anchored circumferentially either with two rows of ProTack™ (Covidien, New Haven, CT, USA) alone or transfacial sling sutures plus ProTack™. Port sites were closed with absorbable sutures. In the laparoscopy-assisted procedure, the sac was dissected via a mini-incision in the skin, the defect was repaired with interrupted non-absorbable suture and the mesh was fixed intraperitoneally using a laparoscopic approach. This technique was preferred by one of the surgeons for densely adherent hernia sacs that were deemed difficult to dissect laparoscopically.

Mesh

Two different types of meshes were used; the Parietex™ Composite mesh and the DynaMesh®-IPOM (FEG Textiltechnik, Aachen, Germany). The Parietex™ composite mesh is made from a composite structure of monofilament polyester textile on one side and a hydrophilic absorbable collagen film on the other side. DynaMesh®-IPOM is a non-coated, 100% synthetic, two-component textile structure (polyvinylidene fluoride and polypropylene).

Definitions

A small hernia defect was defined as one with a maximum dimension of less than 4cm. A medium-sized defect was defined as 4–10cm and a large defect was defined as being greater than 10cm.[8] High BMI was defined as greater than 30kg/m^2. Hernia recurrence was defined as radiological evidence of the same.

Statistical analysis

Statistical analysis was performed using SPSS® (IBM) software version 20. The Mann-Whitney U test was used to compare quantitative variables with non-normal distribution. Patient demographics and operative characteristics were compared using the Fisher's exact test or the Chi-square test; *P* values of less than 0.05 were considered as statistically significant. All the quantitative variables are represented in the results as percentages.

Results

A total of 88 patients underwent LIVHR between January 2008 and December 2010. Of these, 82 patients underwent laparoscopic incisional hernia repair, 5 patients had a laparoscopy-assisted procedure and 1 had conversion to open procedure; 39 patients were male and 49 were female. Median follow-up was 53.6 months (range, 40–61 months). Seventy-five patients (85.2%) presented with a primary incisional hernia, ten (11.4%) presented with a first recurrence and three (3.4%) presented with a second recurrence from their previous hernia repairs. Sixty-six patients (75%) had single defect either smaller than 4cm or between 4cm and 10cm; twenty-two patients (25%) had multiple defects. Twenty-six patients with a median age of 61 years (range, 24–79 years) underwent LIVHR with a DynaMesh®-IPOM mesh, and Parietex™ Composite mesh was used in 62 patients with a median age of 57.5 years (range, 29–77 years). The male : female ratio was 1 : 1.89 in the DynaMesh®-IPOM mesh group and 1 : 1.07 in the Parietex™ Composite mesh group. BMI was high in 12 patients (46%) in the DynaMesh®-IPOM mesh group and in 35 (56.45%) in the Parietex™ Composite mesh group. Most patients in both groups (77% in DynaMesh®-IPOM mesh group and 74% in Parietex™ Composite mesh group) had a single defect. The characteristics of patients in the two groups were similar (Table 1). While the procedures were performed by four consultants in total, over the period of the study two of them exclusively used DynaMesh®-IPOM and two exclusively used Parietex™ Composite mesh.

There was no significant difference in operating time between patients with a high BMI (*n*=46) and those with a lower BMI (*n*=42). Although patients with a high BMI had a higher number of complications (23.9% vs. 19.0%), this was not statistically significant. Similarly, although statistically not significant, a higher ASA grade was associated with a higher number of complications (ASA I 15% vs. ASA II 21.8% vs. ASA III 30.8%). There was no significant difference in the recurrence rate between single vs. multiple defect groups (4.50% vs. 9%, *P*=0.423). In 45 patients, only ProTack™ was used to fix the mesh, whereas in 43 patients both ProTack™ and transfascial suturing were used. Incidence of conversion to open operation was 1.1%.

There was no mortality in the study. Overall morbidity was 20.5%. Two patients (2.2%) developed a chest infection in the postoperative period and one developed peritonitis in the immediate postoperative period, which

Table 1 Characteristics of two mesh groups

	DynaMesh®-IPOM	Parietex™ Composite	*P* value
Total (*n*)	26	62	
Median age (years) (range)	61 (24–79)	57.5 (29–77)	0.88[a]
Sex:			0.244[b]
Male	9	30	
Female	17	32	
Body mass index (kg/m^2):			0.61[b]
< 30	14	27	
30–35	7	23	
> 35	5	12	
ASA grade:			0.14[c]
1	4	16	
2	20	34	
3	2	12	
Defect:			0.79[b]
Single	20	46	
Multiple	6	16	

ASA = American Association of Anesthesiologists
[a]Mann-Whitney U test
[b]Chi-square test
[c]Fisher's exact test

required a laparotomy, repair of enterotomy and removal of the mesh. One patient required a diagnostic laparoscopy on the first postoperative day for signs of peritonitis but no cause was found on laparoscopy for the same. Wound infection and sinus formation occurred in one patient with the Parietex™ Composite mesh (1.1%).

The DynaMesh®-IPOM group was associated with a significantly higher incidence of intestinal obstruction secondary to adhesions compared with the Parietex™ Composite group (*n*=3, 11.5%, vs. *n*=0, 0%; *P*=0.006). Of the three patients from the DynaMesh®-IPOM group who developed intestinal obstruction (CT-proven), one required a laparotomy with removal of the mesh on 17th postoperative day. This patient had a large defect, for which two large DynaMesh®-IPOM meshes had been used. At laparotomy, there were minimal interbowel loop adhesions and the small bowel loops were found to be extensively adherent to whole surface of the DynaMesh®-IPOM mesh. The two remaining patients were managed conservatively. The breakdown of various other factors in these patients is shown in Table 2.

Mesh fixation in all three patients was with ProTack™. Eight patients (12.9%) in the Parietex™ Composite mesh group developed a recurrence (Table 3) in comparison with one patient (3.8%) in the DynaMesh®-IPOM mesh group (*P*=0.201). There were no patients with seroma or hematoma formation in the DynaMesh®-IPOM mesh group, whereas four patients (6.4%) in the Parietex™ Composite mesh group (*P*=0.185) developed a seroma and/or haematoma. Of these, two patients developed a haematoma in the early postoperative period, which was assessed clinically and with ultrasound, and two patients were diagnosed with a seroma on ultrasound scan 6 weeks postoperatively, which settled spontaneously in follow-up and required no further intervention.

Discussion

While laparoscopic repair of incisional hernia has been established as a well-accepted technique with benefits over the open procedure, there are concerns over a higher incidence of intraperitoneal onlay mesh (IPOM) related complications and higher rates of visceral injuries. Since the introduction of laparoscopic incisional hernia repair, various types of mesh have been introduced. However, the search for the 'ideal' mesh, which causes the fewest adhesions, seroma and infection continues. The aim of this study was to add to the current evidence base and to help inform future practice.

Our findings suggest that there is a higher incidence of mesh-related complications associated with use of the DynaMesh®-IPOM compared with Parietex™ Composite mesh in LIVHR. In a small series of patients, DynaMesh®-IPOM was associated with a high incidence of bowel obstruction caused by adhesion of the whole surface of the mesh to the bowel, with histologically proven severe foreign body reaction in the bowel.[9] Various experimental models and studies suggest decreased adhesion formation with the use of the Parietex™ Composite mesh,[10–14] with most suggesting that coated meshes perform better, with less adhesion formation. The guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias suggest that more research is needed to understand the mesh requirement for individual groups of patients who react differently to different types of mesh.[15]

Seroma formation post-LIVHR is also common, with various studies having reported the occurrence of seroma in the range of 4–8% following LIVHR.[15] A slightly higher rate of seroma/haematoma formation was noted in the Parietex™ Composite group in our study. Coated meshes, which are commonly used in intraperitoneal mesh repairs, are typically associated with seroma formation because of the resulting impaired drainage of fluid due to the barrier coating.[9] There may be other contributing factors, such as the number and size of the defects, difficulty of dissection, mesh fixation technique and operation time.[15]

The optimal mesh type for LIVHR has yet to be established. Previous randomised trials in the field of incisional hernia have tended to focus on either the approach (laparoscopic vs. open) or method of fixation (tacker, suture, glue, etc.). There has been only one randomised controlled trial comparing mesh type (titanium-coated lightweight mesh vs. standard composite mesh), which showed no differences in recurrence rates but lower incidence of pain-

Table 2 Breakdown of characteristics of patients who had laparoscopic incisional and ventral hernia repair and complications

Age (years)	Sex	BMI (kg/m^2)	ASA grade	Indication	Defect	Mesh			Duration of procedure (minutes)	Complication (management)	Grade of complications[a]
						Type	Size (cm)	Fixation technique			
37	M	36	2	First recurrence	Single	DynaMesh®-IPOM	20 × 20	ProTack™	110	Small bowel obstruction (conservative)	I
31	F	29.5	1	Primary	Single	DynaMesh®-IPOM	10 × 15	ProTack™	63	Small bowel obstruction (conservative)	I
55	M	36	2	Primary	Single	DynaMesh®-IPOM	15 × 20, 20 × 30	ProTack™	130	Adhesive obstruction (laparotomy)	IIIB
75	M	22	2	Primary	Single	Parietex™ Composite	20 × 15	ProTack™ and transfacial sutures	120	Seroma	I
34	M	25	1	Primary	Single	Parietex™ Composite	20 × 15	ProTack™ and transfacial sutures	60	Hematoma	I
70	M	42	3	First recurrence	Single	Parietex™ Composite	30 × 20	ProTack™ and transfacial sutures	120	Hematoma	I
52	M	31	2	Primary	Single	Parietex™ Composite	20 × 15	ProTack™ and transfacial sutures	150	Seroma	I

ASA = American Association of Anesthesiologists; BMI = body mass index
[a]According to modified Clavien–Dindo classification of surgical complications

related complications in the titanium-coated mesh group.[16] There are only a few comparative studies of mesh types in LIVHR, with only Chelala *et al.*,[17] reporting long-term follow-up of 85 patients undergoing LIVHR from a cohort of 733 who had undergone repeat laparoscopy for various reasons. Serosal adhesions were found in only 10% of cases with no mesh-related complications.

In our study, a higher (although not statistically significant) recurrence rate of 12.9% was noted in the Parietex™ Composite mesh group as compared to the DynaMesh®-IPOM mesh group. Comparable single-institution case series and one multicentre randomised study reported recurrence rates as low as 0–2.5%,[18–22] whereas prospective national registries have suggested much higher recurrence rates of 15.5% at a median of 21 months follow up.[6] Other contributing factors for recurrence of hernia include the number and size of the defects, difficulty of dissection, mesh fixation technique and operation.[18–22] Our study showed no significant relation between mesh fixation with transfascial sutures and non-absorbable tackers and recurrence of hernia, which is consistent with the existing literature.[23,24] There has been a recent focus on the use of fibrin glue for mesh fixation, particularly in areas such as the subcostal margins and close to the xiphisternum and pelvis. Other studies have emphasised that mesh fixation using fibrin glue in patients with LIVHR is associated with less postoperative pain.[25,26] The association between postoperative pain and fixation devices needs further research.

We accept the limitations of our study, which was performed retrospectively and includes a relatively small number of patients. However, further to this study, the practice in our hospital has been changed and we have now discontinued using DynaMesh®-IPOM in LIVHR. We appreciate that there is a need to undertake well-designed, multicentre, randomised controlled trials to investigate the various types of meshes used in LIVHR, with a view to informing future practice.

Conclusions

LIVHR is a safe and feasible technique. In our study, Dynamesh®-IPOM has been shown to be associated with a significantly higher incidence of adhesion-related bowel obstruction, albeit with a lower incidence of recurrence, seroma and haematoma formation as compared with Parietex™ Composite mesh. However, there is a need for further well-designed, multicentre randomised controlled studies to investigate the use of these meshes.

Table 3 Breakdown of characteristics of patients who had LIVHR repair and recurrence of hernia as a complication

Age (years)	Sex	BMI (kg/m^2)	ASA grade	Indication	Type of defect	Mesh			Duration of procedure (minutes)	Duration of recurrence from hernia repair (days)
						Type	Size (cm)	Fixation technique		
37	M	41	2	Second recurrence	Multiple	Parietex™ Composite	25 × 20, 20 × 15	ProTack™	75	> 30 days
74	F	33	3	Primary	Single	Parietex™ Composite	25 × 20	ProTack™	125	> 30 days
37	M	33	1	Primary	Single	Parietex™ Composite	25 × 20	ProTack™	110	> 30 days
62	F	35	3	Primary	Single	Parietex™ Composite	15 × 10	ProTack™ and transfacial sutures	75	> 30 days
69	M	33	2	Primary	Multiple	Parietex™ Composite	15 × 10	ProTack™ and transfacial sutures	90	> 30 days
65	M	32	2	First recurrence	Single	Parietex™ Composite	20 × 15	ProTack™	100	> 30 days
42	F	38	2	Primary	Single	Parietex™ Composite	25 × 20	ProTack™ and transfacial sutures	115	> 30 days
67	M	33	2	Primary	Multiple	Parietex™ Composite	25 × 20	ProTack™ and transfacial sutures	120	> 30 days
79	F	28	2	Primary	Single	DynaMesh®-IPOM	12 × 12	ProTack™	205	< 30 days

ASA = American Association of Anesthesiologists; BMI = body mass index

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